
Learning to teach by lesson study

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This paper reports on the experience of student teachers in Brunei Darussalam when a variation framework is taught to them as part of a teacher education programme that uses the principles of lesson study for learning to teach

Organisation

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 - designing a teaching situation
 - the teacher education programme
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 - the object of learning of the student teachers
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Context

The terms teacher-centered and student-centered to describe teaching are both commonly used in Brunei where the former is used by teachers to refer to one-way teacher transmission, and the latter to refer to interaction *per se* and without reference to its relationship to the object of learning

The emphasis has been on rote learning, on form over content, on summative assessment. Schools have been a major socialization agency to this end. But change is on the government's agenda

The teachers' repertoire needs to expand to include object-of-learning-centred (Runesson, 2005)

Designing a teaching situation

For example, what is price?

Early work in phenomenography, recording and analysing learners' ways of experiencing the object 'price', revealed two qualitative differences in conception of price held by university students of economics (Dahlgren & Marton, 1978):

- A. a conception of price as an entity that is determined by a dynamic system (i.e. determined by the structure of the market in which it is sold and bought)

 - B. a conception of price as a property of a commodity comparable with its colour, size ...
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Designing a teaching situation

Conception A represents a more powerful object of learning than B – it has greater explanatory power and therefore affords the student who sees price in this way a greater capability for explaining price in novel contexts.

To make it possible for a learner to see this object – the intended object of learning - something has to happen. According to the variation framework (Marton & Booth, 1997), the certain critical aspects must be experienced simultaneously by the learner: roughly, supply *and* demand in interaction.

More precisely, learners need to see that price is determined by the structure of the market for a commodity, a structure that can be anything from competitive to monopolistic and all combinations in between. For this to be learnt, the relevant variation to be experienced is variation in the structure of the market.

Designing a teaching situation

Teaching arrangements that have this market understanding (conception A) as the intended object of learning typically start with an exploration of the learners' experience of the *same* commodity (e.g. a can of a particular drink) having different prices when purchased in different locations where the market conditions vary: in town, the hotel bar, the supermarket, the street vendor, on a train passing through and so on.

Here the intention is to vary the market structure represented by these alternative outlets but to keep the product and its properties invariant. The market structure varies in the degree of competition that exists. The aim is to direct the awareness of the learner to those aspects of the phenomenon which are found in conception A. This may foreground for the learner the critical aspects of demand in relation to supply.

The teacher education programme

The framework of variation is introduced. Examples are used to explore how it is possible to incorporate relevant variation in the planning of the intended object of learning. The programme introduces the idea that how the enacted object of learning is constituted is important for the possibility of learning. It encourages the student teachers to identify powerful objects of learning in relation to the topics they must teach. It involves lesson study but with the distinction that the whole process is informed by the use of the variation framework.

A feature of the programme is peer teaching. Here variation is introduced by having small teams of student teachers plan and teach the same topic. And by having the students reveal their experience of the lesson. It allows them to explore questions such as why something is learned in one situation but not in another. It allows them to see how different patterns of variation in classroom situations - where ostensibly the same topic has been interpreted differently by the teams of teachers - offer opportunities for students to learn different things.

The data

From an analysis of 41 examples of student teachers' written reflections on the intended and enacted objects of learning of 15 lessons on seven objects of learning from economics or accounting, insights emerged into the student teachers' experience of the variation framework in relation to these objects of learning. The student teachers were completing Methods courses in the second or third years of four-year BScEd or BAEd degrees. The teaching reported here was carried out at the end of the year.

Analysis

Instances were identified where a link was established between the pattern of variation provided by the lesson and its effectiveness, and where it was not. Texts of individuals in the same teaching team were compared to find similarities and differences in reflection on the same lesson. The texts of different teaching teams, ostensibly teaching the same thing, were compared. Instances were identified where variation in the enacted object of learning of the teams' lessons was a point of reference, and where it was not.

Objects of learning

What determines wages?

What affects the breakeven output for a business?

How should depreciation of an asset be estimated?

What determines prices?

Object of learning: what determines wages?

In lesson I, two student teachers collaborating on planning and teaching a lesson on wages asked their students to form three groups. Each group was given the same set of job advertisements with the wage or salary omitted in each case and asked to rank the occupations from highest to lowest in terms of likely wage for the job.

In lesson II, a second pair of student teachers teaching the *same topic* conducted their lesson in the following way. The students were shown a list of different types of job with an allocated wage for each. The students were asked which job they would prefer. Then the teacher explained to the students the reasons for the wage differentials among different occupations.

Results

Object of learning: what determines wages?

Lesson I

What is particularly interesting from the groups' rankings is that each of the groups ranked the advertised jobs differently from one another, particularly the top three jobs, as follows:

<i>Group A</i>	<i>Group B</i>	<i>Group C</i>
<i>1. computer engineer</i>	<i>1. government school teacher</i>	<i>1. private school teacher</i>
<i>2. private school teacher</i>	<i>2. private school teacher</i>	<i>2. government school teach</i>
<i>3. government school teacher</i>	<i>3. computer engineer</i>	<i>3. computer engineer</i>

The class discussion brought about by the variations in job ranking made the students aware of their way of seeing wage rate determination, e.g. most of the students based their reasons for their job ranking on qualifications and experience. In other words, the students are focusing on the supply side.

We then asked the first group why they think that a computer engineer has the highest wage. A member responded that from his experience he is quite sure... referring to his relative who is a computer engineer ...the supply of this kind of [labour] is scarce ...while the demand is high considering the world is now technology-oriented.

Lesson I

After that we discussed the variations between the school teachers. Some students said that government would pay them higher than private schools simply because the government would be able to pay them. They are not aware at first that the difference is due to the nature of the market. Government teachers are in a monopsony [buyers'] market. Due to the high supply of teachers and the government is the sole employer, therefore the government is able to pay them at a fixed wage and the teachers have no power to change their wage. There can be many private schools, putting them in a very competitive situation. So, in order to attract the best teacher, they are willing to offer higher wages. Therefore, the market for private school teachers tends to be more competitive in nature. However, we (teachers) did not give the answers directly (no spoon feeding) but continued in discussing the matter. The discussion was long but useful in making students voice their opinions.

Through the discussions, the teachers, who act as facilitators, would bring to the students' attention the demand side of labour. Seeing in this way ... led to an ... awareness that both market supply and demand influence wages rates, not just the supply side.

The resource materials must be formulated in such a way that it would result in variation to prompt discussion from and among students. In class discussions, the various explanations voiced out by the students makes students aware of other aspects alien to him/her resulting in an increase in awareness of seeing things.

From the simple activity, it produces a variation where students bring outside knowledge in the lesson and others are responding to that idea.

Object of learning: what determines wages?

Lesson II

For these student teachers a dimension of variation was provided by comparing these two lessons on the same intended object of learning. It revealed the critical aspect of the students' role as a source of variation. In reflecting on their lesson compared with the one described above, one of these student teachers explained:

... despite the effectiveness [of the other lesson], they could encounter some drawbacks if for instance students do not create variation in their choice. If this situation occurs, then the teachers would have difficulty ... Another drawback would be that students' participation in a group discussion will not happen if most ... are introvert students who are shy and very quiet. Only the extrovert students will contribute ideas since they are socially confident in contributing ideas.

This is a reminder that while variation may be a necessary condition for learning, it is not the only condition. However, she concluded with reference to the first lesson:

A lesson was easily created where students are able to think by themselves regarding the critical aspects...[in contrast] our lesson needs much improvement so that all the lesson's objectives could be met.

Object of learning: what affects the breakeven output for a business?

In lesson I student teachers collaborating on a lesson on 'breakeven' set up a scenario where groups of students were provided with invariant cost data but variation in the prices charged by different businesses in the fast food market, and the groups were asked to plot, on transparencies, graphs of costs and revenues. The breakeven point for any business is the achievement of a level of sales revenue that covers its costs.

In lesson II student teachers handling the *same* topic approached the lesson in stages. In stage 1 a picture of a scale balance was used to explain the concept of break even. In stage 2 the teacher defined costs and revenues. In stage 3 the teacher presented a formula for calculating the break even point for any business. In stage 4, given the same costs and revenue data, students in groups were required to draw a break even chart, i.e. no variation was introduced. In stage 5 the teachers verified the students' charts.

Results

Object of learning: what affects the breakeven output for a business?

Lesson I

...the graph that was drawn by each group was collected and presented by the teacher. Since each group was calculating different selling price, as each graph was overlapped, the curve line that appears to stand out was the total revenue ...when these differences were shown, the effects can be seen immediately which was exactly what we hoped to achieve... when selling price is high, less quantity is needed to breakeven

What is very crucial in the group activity is the variation given among groups, otherwise it would be pointless.

Results

Object of learning: what affects the breakeven output for a business?

Lesson II

Our explanation did not reach the students. It was decontextualised and it seemed to be an old stereotype of a lecture... Students also commented that it was rote learning.

... it did not produce any variation for the students to see. This was also agreed by the students when they produced the same breakeven graphs. It was a good point ... we only realized the issue when we put up the [students' breakeven charts] on the board and there was nothing much to be explained.

We have tried our best to conduct the lesson. However, much ... could be done to make the lesson more effective. For instance, by creating variation, it will stimulate student's thinking because they will question and analyse the different outcomes.

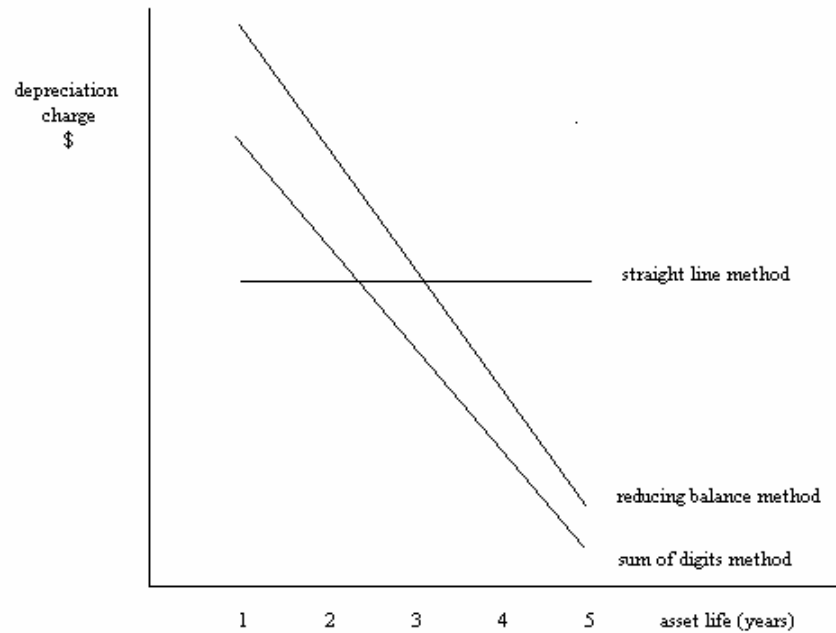
Object of learning: how should depreciation of an asset be estimated?

In lesson 1, the students were grouped and asked to calculate depreciation using one or other of the methods and to produce a graph of depreciation charge against year of life of the asset. The data on cost, estimated life and residual value of the asset were kept invariant for all the groups. Only the method of calculation was varied. The graphs produced for each method were overlaid and presented to the class on an ohp so that the effect of the methods could be compared (Figure 1) and the students were asked the question, 'Which is the best?'

Then a second systematic variation was introduced. The method – reducing balance - and residual value were held invariant and the estimated period of life varied. Subsequently, a third systematic variation was introduced with the method remaining invariant and the residual value varied. The effects of these changes were shown simultaneously on a graph using a PowerPoint presentation

Variation in depreciation charge by method

Figure 1 Variation in depreciation charge by method used



Object of learning: how should depreciation of an asset be estimated?

In lesson II, A second team of student teachers taught the same topic but the enacted object of learning differed in an important way. In this lesson groups of students were asked to draw graphs using two different methods as before but in this case, crucially, the depreciation rates given by the teachers were also varied for the two methods. As a result of this, what it was possible for the students to learn differed markedly. In the second, lesson students did not see that different methods, applied at different stages in the life of an asset, could inflate the net profit of the business and, as a result of this, that accountants are required to apply the same method over the life of an asset – the so-called consistency principle. This object of learning was not made available to the students in the second lesson because the appropriate combination of variation and invariance demonstrated in the first lesson was not presented.

Results

Object of learning: how should depreciation of an asset be estimated?

Lesson I

We were focusing on how three different methods of depreciation – straight line, sum of the digits and reducing balance – can give an impact on a company's net profit. The objective of the lesson was to make students see the variation that using the different methods can have a [differential] impact on company's accounts, and there is no single method which gives the lowest depreciation.

Lots of questions arose regarding the method ... this tells us that they managed to see ... what obtained was, when applying the straight line method, depreciation value is the lowest compared to the other two methods ... for the first two and a half years of the asset's life and it is totally reversed after that. This has been brought up by one of the students.

The powerful thing is if you could choose different methods to give the lowest depreciation, then you would change over the period on which method you would want to apply for the sake of obtaining the lowest value as possible. This issue has been brought up by another student ... there were sounds of people asking, 'Really?'

The object of learning to teach

This created a potentially powerful object of learning for the student teachers who became aware of the effect on the students of the variation they had planned. Another member of the team commented:

...as we try to explain to the students, more variation stand out and because of this the students become more curious ... the students asked lots of questions ... the class was so active that we could not control it.

For this student teacher, the reference to losing control here harks back to the predominant teacher-centered perspective where it is the teacher who provides the information and asks the questions, not the students.

The object of learning to teach

In contrast – and here it can be argued that a dimension of variation is opened with respect to a critical aspect of learning to teach – another of the teaching team reflected:

Instead of arguing with the students, we should agree ... the students were actually correct and [their views] could actually be taken into account. The variation did stand out ... which made the students more curious and keep on arising with marvelous questions. We can conclude that from the variation, the students saw that: firstly, there is no best method of depreciation; secondly, it all depends on the company to decide which years [they] are focusing at; thirdly, the company should abide by the concept of consistency rule meaning [they] could not switch ... method from [year to year]; fourthly, the company could only choose one method; fifthly, the company might as well total up the depreciation value... using all three methods and decide ... if [it] insists in knowing which ... gives the lowest expense.

The response of the students to the experience of variation took the student teachers by surprise and created an opportunity for them to learn about learning variation. Their reflection on the lesson was object-of-learning-centered.

Results

Object of learning: how should depreciation of an asset be estimated?

Lesson II

After the students had finished with the activity, we collected the transparencies from all the groups and showed the variations using the two different methods at different depreciation rates. While explaining the variation, we noticed that some of the students looked confused.

The difference in the lessons raised some issues for the student teachers. In her reflection on the second lesson, one of the teachers referred to the feedback received:

Some of the observers commented that our lesson [compared to the other on the same topic] was more teacher-centered due to students asking less questions. But we are not sure if this is called teacher-centered. They also bring up the issue of when students ask questions, it means that they don't understand while students don't ask questions means that they understand. However, when students keep quiet or don't ask any questions, it doesn't mean that they understand.

Object of learning: what determines prices

In lessons I and II both teaching teams taught the lesson using similar activities:

Overall, the first group way of teaching and the activities conducted were more or less the same as ours. The only difference was the goods we used as an example. We used chocolate bars ... they used nasi lemak [rice dish] as an example.

Both used a market simulation where roles of consumers and producers were allocated to members of the class.

Results

Object of learning: what determines prices

Lesson I

The simulation activity had some flaws identified by the teachers. In relation to one of the lessons, a student teacher wrote:

The activity itself had a downside. It was that those who became producers were less aware of the more critical experiences being felt by the producers. On the other hand, the producers had to think up prices which will give them profits and yet not lose out in sales to the competition. They experienced it practically, first hand, how a real-world producer might set his prices. Although this may or may not be a big issue seeing as the point of the lesson is mainly to show students how price can be determined by the market, and not how the producer sets and calculates prices. There is a fine difference there but, of course, the experience of being a producer might help more in understanding compared to being a 'passive' consumer.

Results

Object of learning: what determines prices

To overcome this problem, the student teacher focused on his role as teacher:

Naturally, the first area we needed to improve was to get out of the teacher-centric mindset which relied more on the teacher supplying information ... the deficiency in the activity design which led to differing experience level between consumers and producers could have been easily compensated for by a class discussion at the concluding part of the lesson. As such, I will be sure to include more discussion in my future lessons. It is apparently a powerful tool which does not really require much effort on the part of the teacher ...

Without variation, there is no discernment. The teacher's attention here is drawn not to the redesign of the activity – not to the specific object of learning - but to the use of discussion as a generic method of involving students:

... with the teacher gently guiding them to the desired outcome.

In the second teaching team too, there was evidence of the teachers focusing in their reflection less on the object of learning and more on the central role of the teacher:

In order to make sure that the students could fully grasp the main idea of the market as being the determining factor of price... we should have directed and explained clearly what the students need to do ...

Discussion

Being exposed to variation in the enacted object of learning and being able to link this to patterns of variation and invariance presented to the learners provides a powerful object of learning to teach for novice teachers

Object of learning to teach

Patterns of variation for student teachers operate at two levels: (i) that pattern experienced by their students in the classroom which determines the object of learning in class, and (ii) that pattern experienced by the students teachers formed by their responses to the differential effects of the arrangements for learning in the classroom

The dialectic between the object of learning something by students in the classroom and the object of learning to teach by novice teachers offers the potential for an improvement in teaching and in student achievement. The object of learning to teach becomes more powerful. It is seen as the identification of a pattern of variation and invariance that will afford students the opportunity to appropriate a specific object of learning (direct object) and the capability to plan, teach and review a learning situation in terms of the presence or not of an appropriate pattern of variation (indirect object)
